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Immediate Water Pollution Control Needs Rio Grande Basin, Colorado, New Mexico and Texas

Federal Water Pollution Control Administration, Dallas, Tex

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PB 266 386

IMMEDIATE WATER POLLUTION CONTROL NEEDS

RIO GRANDE BASIN

COLORADO, NEW MEXICO, AND TEXAS

UNITED STATES
DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTH CENTRAL REGION
DALLAS, TEXAS 75202

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16. ABSTRACT

The purpose of the report is to focus attention on known sources of water pollution in this area and to provide a priority for action to correct existing problems and to prevent future problems.

17. KEY WORDS AND DOCUMENT ANALYSIS

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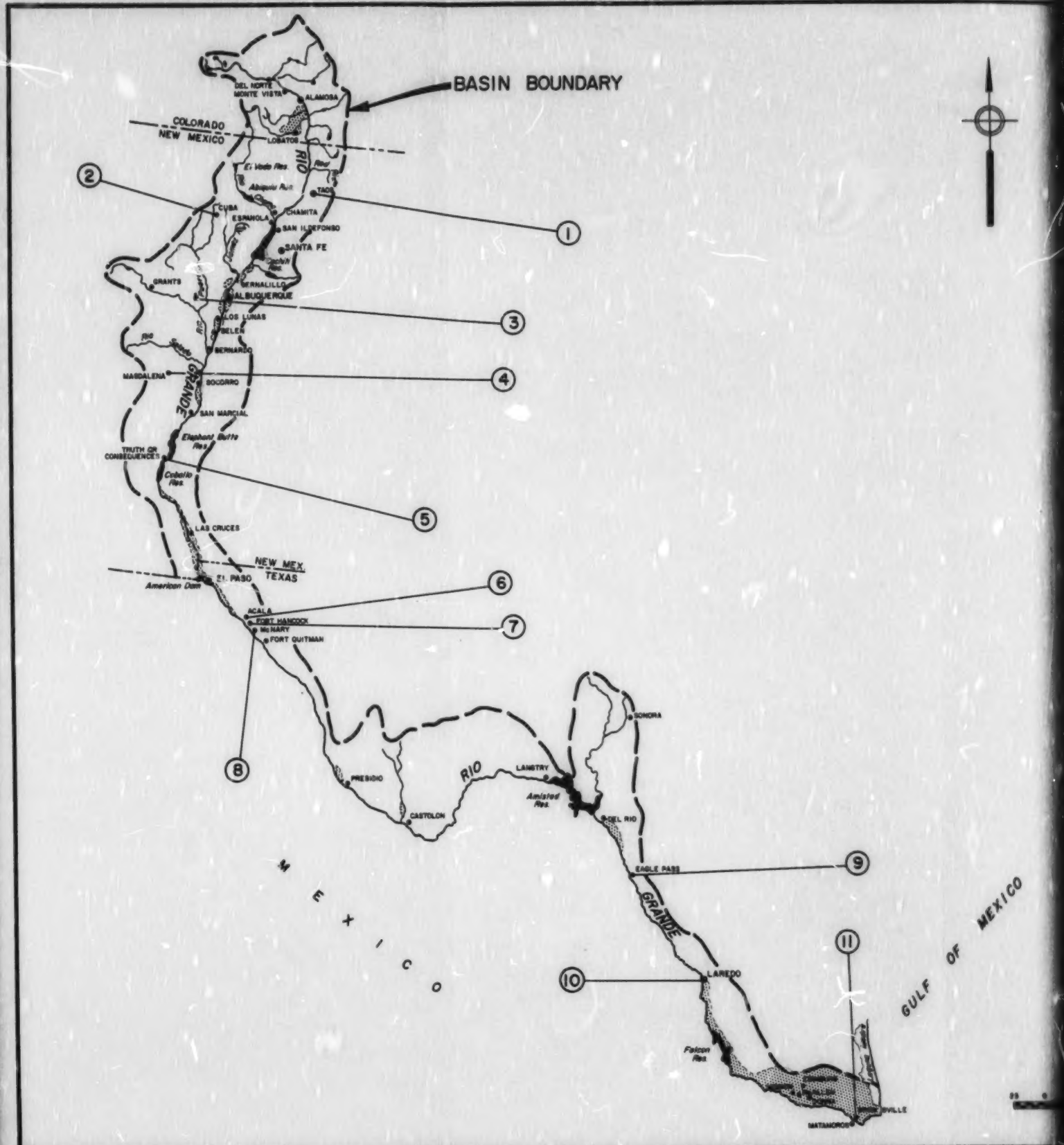
I. Introduction

The purpose of this report is to focus attention on known sources of pollution and to provide a priority for action to correct the existing water pollution problems and prevent future problems in the Rio Grande (see Figure 1), an interstate stream, and its tributaries. The report does not include the Pecos River or that portion of the basin within the Republic of Mexico. It does, however, include that area along the Rio Grande which drains to the Laguna Madre. This report is based on compilations of available data of the Federal Water Pollution Control Administration, South Central Region, and the pollution control agencies of Colorado, New Mexico, and Texas. No detailed water quality surveys or engineering studies were carried out for the preparation of this report.

The findings of this report are based on the best information available at this time on water quality conditions and immediate and potential pollution abatement needs. The omission of any particular town, industry, or other establishment from this report does not imply that an immediate or potential pollution abatement need may not exist in that particular area. Priorities listed are based solely on an evaluation of the Rio Grande basin and not on a relative basis with other basins in the South Central Region.

Authority is given in Section 3(a) of the Federal Water Pollution Control Act, as amended, for the preparation or development of comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof and improving the sanitary conditions of surface and underground waters. This report, by describing the immediate needs for controlling water pollution in the Rio Grande basin, represents the first step in the development of a comprehensive program to control water pollution for this river.


BASIN BOUNDARY
COLORADO
NEW MEXICO
DEL NORTE
MONTE VISTA
ALAMOSA
LOGATOS
RIO
GRANDE
CHAMITA
SAN ILDEFONSO
SANTA FE
CUBA
ESPANOLA
GRANTS
BERNALILLO
ALBUQUERQUE
LOS LUNAS
BELEN
BERNARDO
MAGDALENA
SOCORRO
SAN MARCIAL
TRUTH OR CONSEQUENCES
LAS CRUCES
NEW MEX.
TEXAS
EL PASO
American Dam
ACALA
FORT HANCOCK
McNARY
FORT QUITMAN
PRESIDIO
CASTOLON
LANGTRY
Amistad Res.
DEL RIO
EAGLE PASS
LAREDO
Falcon Res.
SONORA
MEXICO
GULF OF MEXICO
MATAMOROS
1
2
3
4
5
6
7
8
9
10
11

LEGEND

(2) NEEDS

IRRIGATION AREAS

(9)

(11)

GULF OF MEXICO

MATAMOROS

Scale in Miles

25 0 25 50 75 100 125 150 175 200

IMMEDIATE WATER POLLUTION CONTROL NEEDS
RIO GRANDE BASIN

LOCATION MAP

UNITED STATES DEPARTMENT OF THE INTERIOR
Federal Water Pollution Control Administration
SOUTH CENTRAL REGION APR 1967 DALLAS, TEXAS

FIGURE 1

II. Summary of Immediate Control Needs

The most significant water pollution problem results from the irrigation of over 2,000,000 acres of land in the Rio Grande basin with about half of this amount in the United States. Quality degradation, indicated by high salinity, heavy silt loads, and increased hardness and temperature, results in damages to municipal, industrial, recreational, and agricultural uses of the stream in an area where water supplies are very limited. The immediate pollution control needs are listed below and grouped into categories: waste treatment, other pollution control practices, institutional practices, and research.

Waste Treatment

Location	Responsibility	Need	Priority
1	City of Taos, New Mexico	Secondary settling using lagoons	B
2	Town of Cuba, New Mexico	Primary & secondary treatment	B
3	U.S. Bureau of Indian Affairs, Canoncito Boarding School, New Mexico	Expand lagoons	B
4	Town of Magdalena, New Mexico	Primary & secondary treatment	B
5	City of Truth or Consequences, New Mexico	Secondary settling using lagoons and chlorination	B
6	Town of Acala, Texas	Primary & secondary treatment	B
7	Town of Fort Hancock, Texas	Primary & secondary treatment	B
8	Town of McNary, Texas	Primary & secondary treatment	B
9	City of Eagle Pass, Texas	Expansion of primary and addition of secondary treatment	B
10	U.S. Air Force, Laredo Air Force Base, Laredo, Texas	Industrial waste treatment facilities	B

Waste Treatment (Continued)

Location	Responsibility	Need	Priority
11	City of Brownsville, Texas	Expansion of primary and addition of secondary treatment	B
	U.S. Coast Guard, Brownsville Moorings, Brownsville, Texas	Add secondary treatment	B
Other Pollution Control Practices			
Basin-wide	Agricultural activities	Improved land management for erosion control	B
Basin-wide	Department of Agriculture, local institutions	Construction of flood retarding and silt retention structures	B
Institutional Practices			
Basin-wide	States of Colorado, New Mexico, & Texas	Prepare and adopt water quality standards	A
Basin-wide	States of Colorado, and Texas	Consider legislation to provide appropriations for state participation in grants for construction of sewage treatment works	B
Basin-wide	State of New Mexico	Consider increasing appropriations for state program of grants for construction of sewage treatment works	B
Basin-wide	States of Colorado, New Mexico, & Texas	Consider expansion of water quality control surveillance program (including treatment plant operation and maintenance)	A
Basin-	States of Colorado, New Mexico, & Texas	Prepare and maintain a complete industrial waste discharge inventory for industries not connected with municipal treatment systems.	B

Institutional Practices (Continued)

Location	Responsibility	Need	Priority
Basin-	States of Colorado, New Mexico, & Texas, FWPCA, Bureau of Reclamation, Department of Agriculture	Continue research and conduct joint study to determine feasible methods of preventing water quality degradation due to irrigation return flows.	A

III. Immediate Control Needs

Various measures are needed to control water pollution of the Rio Grande and its tributaries. The primary need is to reduce mineral concentrations, especially salt, in order to meet water demands within the basin. These demands are for municipal, industrial, agricultural supplies, recreation, and fish and wildlife propagation.

The actions recommended here though not all encompassing are, however, prerequisite to good water quality planning and should be included in local, State, and Federal programming for water pollution control. Background for these immediate needs is summarized in Chapter VI.

Waste Treatment

New or expanded treatment facilities are needed by at least 9 communities, and 3 Federal installations (as listed in the summary table). The list of needs is not considered all inclusive and does not reflect projected needs due to future obsolescence or to expanded or changed water uses.

Other Pollution Control Practices

Land management improvements by local agricultural activities are needed to improve erosion control and thus to reduce silt pollution problems in the basin. Flood retarding and silt retention structures built by local institutions aided by the U.S. Department of Agriculture are needed to control runoff with a resulting reduction in erosion and a corresponding achievement of land restoration.

Institutional Practices

To strengthen the States' position on prevention, control and abatement of stream pollution, water quality standards are needed on interstate and intrastate streams. State participation is needed in Colorado and Texas in the waste treatment plant construction grants program to accelerate the construction of needed improvements. The State of New Mexico needs to increase the appropriations for its present grant program for the construction of sewage treatment works. Increased surveillance and operation inspection of sewage and industrial waste treatment plants are needed to locate and identify existing or potential serious pollution problems. For more rigid control over industrial pollution and aid in solving complex stream quality problems, a complete and up-to-date inventory is needed of industrial waste discharges to basin streams, listing quantity and quality of effluent and other pertinent data.

Research

Continued research is needed to solve the most significant pollution problem in the Rio Grande basin, that of salinity due to irrigation return flows. A cooperative research and study effort of the States of Colorado, New Mexico, and Texas, Federal Water Pollution Control Administration, the Bureau of Reclamation, and the Department of Agriculture is needed to determine feasible methods of preventing water quality degradation due to irrigation return flows.

IV. Costs

The estimated cost of pollution control measures listed in the summary table is shown in the following tabulation:

Item		Estimated Cost
Municipalities:		
New treatment facilities		$ 263,000
Expansion of treatment facilities		1,515,000
	Subtotal	$1,778,000
Federal Installations:		
Expansion of treatment facilities		$ 35,000
New industrial waste treatment facilities		77,000
	Subtotal	$ 112,000
	TOTAL	$1,890,000

No cost estimates were made of land management and silt control programs, or institutional and research needs.

V. Recent Progress in Pollution Control

With the enactment of Public Law 660 in 1956, authorizing Federal contributions to costs of new municipal sewage treatment plants, came a significant increase in the construction of new pollution abatement works in the Rio Grande basin. All of the major municipalities in the New Mexico portion of this basin have constructed additional sewage treatment facilities. The most significant of these are Albuquerque and Las Cruces, the two largest contributors of sewage effluent to the Rio Grande. Both provide primary and secondary treatment and have made recent improvements to the water pollution control facilities, approximately doubling capacity.

Public Law 660 was instrumental in improving municipal sewage treatment in Texas cities along the Rio Grande, as was the Texas Water Pollution Control Act of 1961. The latter inspired improved treatment of industrial waste, as well as municipal waste. Significant construction has been completed at the municipalities of Edinburg, Donna, McAllen, Mission, and Sonora.

Several industries in the Texas Rio Grande basin have made recent progress in pollution control. The most significant has been the cooperation in the lower Rio Grande Valley between industries and municipalities to treat citrus and other industrial wastes

Some recent progress has been made in silt control along the Rio Grande. The Abiquiu Reservoir has been constructed on the Rio Chama in New Mexico specifically to control silt. Amistad Reservoir near Del Rio, Texas, now under construction, will provide for additional silt removal.

These pollution control steps have resulted in localized water quality improvements.

VI. Background for Recommendations

Pertinent Basin Characteristics

The Rio Grande originates near the Continental Divide in southern Colorado. The river flows south through the State of New Mexico to El Paso, Texas, where it becomes an international boundary flowing southeastwardly between the United States and the Republic of Mexico. The river empties into the Gulf of Mexico near Brownsville, Texas, and Matamoros, Mexico.

The Rio Grande has a drainage basin encompassing 335,000 square miles; however, only about 182,000 square miles contributes runoff to the main stream. Reservoirs in the basin have a total storage capacity of 8,736,200 acre-feet in addition to the International Falcon Reservoir with a capacity of 2,400,000 acre-feet.

Flow from the Rio Grande into the Gulf of Mexico averaged 2,600,000 acre-feet annually prior to the construction of Falcon Dam, at which time the flow was reduced to about 446,000 acre-feet per year for the period 1954-1963.

The total population of the Rio Grande basin is approximately 1,400,000. The two largest cities in the basin are El Paso, Texas (280,000), and Albuquerque, New Mexico (205,000). Other major population centers in the basin include Santa Fe and Las Cruces, New Mexico, and Del Rio, Laredo, McAllen, Brownsville, and Harlingen, Texas.

Present Water Quality Problems

The most significant pollution problem in the Rio Grande basin is water quality degradation due to irrigation return flows. Water quality in the basin is also significantly altered by the silt loads which are carried in the main stem and some of the tributaries. Pollution from municipal and industrial discharges is generally limited to localized areas.

Irrigation Return Flows

Since the volume of runoff in the basin is less than the volume of irrigation water applied, the effect of irrigation is to concentrate minerals in the return flows to the general degradation of water downstream. Turbidity and dissolved solids concentration is increased by irrigation. This increase is further reflected in sulfates, chlorides, and hardness. Temperature is also generally increased due to irrigation. The increased temperatures emphasize tastes and odors, promote the growth of aquatic weeds and interfere with some types of aquatic life. Indications are that irrigation return flows may concentrate nutrients such as nitrogen and phosphorus. Since the

development of numerous chemicals for agricultural purposes such as insect sprays and weed control, irrigation return flows are also potential medians by which those chemicals can enter the receiving stream. Despite all these other effects of irrigation, salinity remains as the major water quality problem of the Rio Grande.

In 1964, there were over 500,000 irrigated acres in Texas within the Rio Grande basin, of which half were in the Pecos River basin and the subject of a separate report. Another 250,000 acres in New Mexico and about 250,000 acres in Colorado are irrigated within the Rio Grande drainage basin. Also, the Republic of Mexico irrigates about 1,000,000 acres of land from which runoff enters the Rio Grande. Irrigated locations, exclusive of those in Mexico and in the Pecos River basin, are shown on the location map.

Except for some areas adjacent to reservoirs such as Falcon, American Dam, Caballo, and Elephant Butte, most of the water used for irrigation is ground water. The one-half million acres of irrigated land within the United States Rio Grande basin, exclusive of the Pecos River, use approximately one million acre-feet of water annually. Of this amount, an estimated one-third is returned by overflow, runoff, or seepage to the Rio Grande. If a proper salt balance is maintained, the salt concentration is increased 300 percent each time the water is used for irrigation.

The primary factors contributing to the quality of return irrigation water are evaporation and transpiration. The next most important factor affecting the quality of irrigation return flow is the quantity of water applied. This quantity must be sufficient to remove excess mineral matter in order to prevent buildup in the soil. It is common in the arid Rio Grande basin to have drought years during which there is considerable buildup of mineral matter in the soil and other years of more moisture when the mineral matter is leached from the soil. During drought years, some sections of the Rio Grande receive no flow.

The Rio Grande is used at several locations for irrigation from the headwaters in Colorado to the Gulf of Mexico near Brownsville, Texas. Salinity increases as the water proceeds downstream to a maximum near Fort Quitman, Texas. Here, the salinity is generally so great that the water is unfit for irrigation or human consumption. Under average flow conditions (1945), salt concentrations increased about 11 times from 190 to 2,060 mg/l from near San Ildefonso, New Mexico, to Fort Quitman, Texas, and hardness increased almost 600 percent. In the same year, the chloride concentration in the drainage water increased 129 times compared with 10.5 times for sulfate, and 21.4 and 5.1 times for sodium and calcium, respectively. However, it should be pointed out that the mineral concentration increase is due not only to an increase in total minerals but also to a significant decrease in flow. The flow at Fort Quitman is normally less than

40 cfs, which is less than one-tenth that at San Ildefonso because of municipal, industrial, agricultural uses, evaporation, transpiration, and other losses. Often, the flow at Fort Quitman is even less than 10 cfs.

The heaviest concentration of irrigation in the Rio Grande basin on the United States side is between Falcon Dam and the Gulf of Mexico. However, much of the irrigation return flow in this area is diverted directly to the Gulf of Mexico, rather than to the Rio Grande. The other major areas of irrigation are near El Paso, Elephant Butte Reservoir, and Albuquerque, with less concentrated areas near Del Rio, Texas, Chamita, New Mexico, and Lobatos, Colorado.

The improvement of water quality downstream from Fort Quitman is due to limited irrigation and the increased streamflow in the stream from many tributaries in that section of the basin. The mean flow increases over 700 percent between Fort Quitman and Langtry, Texas, while dissolved solids and chloride concentrations decrease more than 50 and 70 percent, respectively.

The mean annual flow increases another million acre-feet between Langtry and Falcon Dam, but the quality of the water remains about the same because of contributions from the Pecos and other tributaries carrying highly mineralized irrigation return flows.

The salinity, due to irrigation return flows in the Rio Grande, renders the stream water unsuitable for irrigation from near El Paso to Del Rio, and unsatisfactory for domestic and industrial uses at most locations below El Paso. The high sulfate and chloride concentrations prevent the use of this water for stream production or other industrial and household uses.

Silt Pollution

A problem of significant proportions in the Rio Grande basin is that of heavy silt loads being carried in the main stem with substantial contributions by some tributaries. The problem is traditionally one with effects being measured in the life of reservoirs; but in addition to this, interruption of water uses results either directly or indirectly.

Heavy silt loads affect light penetration and cover stream bottoms resulting in ecological disturbances which reduce feeding areas for fish and cause certain species to migrate from the area. Other problems involved with heavy silt loads are connected with the additional cost of water treatment for municipal and some industrial supplies.

Table 1 provides a summary of silt loads being carried in the main stem and in the Rio Puerco, a tributary near Albuquerque, New Mexico.

Table 1

Silt Loading

Location	Period	Average Annual Silt Load (Tons)
Rio Grande:		
Ildefonso, New Mexico	1956-1959, 1962	3,502,000
Bernalillo, New Mexico	1956-1959, 1962	5,703,000
Bernardo, New Mexico	1956-1959, 1962	3,705,000
San Marcial, New Mexico	1956-1959, 1962	6,063,000
El Paso, Texas	1949-1963	276,000
Presidio, Texas	1955-1963	3,689,000
Castolon, Texas	1951-1963	7,610,000
Langtry, Texas	1944-1963	8,584,000
Del Rio, Texas	1955-1963	8,078,000
Laredo, Texas	1953-1963	9,203,000
Below Falcon Dam, Texas	1955-1963	46,000
Rio Grande City, Texas	1959-1963	416,000
Brownsville, Texas	1955-1963	327,000
Rio Puerco:		
Bernardo, New Mexico	1956-1959, 1962	8,154,000

Source: U.S. Geological Survey and International Boundary and Water Commission.

Some natural salt pollution exists primarily in the Rio Puerco and Jemez tributaries. This results from natural deposits of calcium sulfate (gypsum) and, to a lesser degree, sodium chloride.

Although at times localized water quality degradation occurs from these natural sources, problems contributed to the main stem are not significant in terms of similar pollutants resulting from irrigation runoff.

Table 2 presents flow and quality characteristics related to natural pollution of the Jemez and Rio Puerco Rivers.

Table 2

Quality Characteristics
of the Jemez and Rio Puerco Rivers

Date of Sample	Flow (cfs)	Sulfate (mg/l)	Chloride (mg/l)	Total Dissolved Solids (mg/l)
Rio Puerco				
January 4, 1953	146	-	52	1970
July 27, 1953	3450	-	71	1190
October 10, 1958	4	1440	82	2270
February 2, 1962	145	936	55	1610
Jemez River				
July 26, 1957	15	-	194	1900

Source: U.S. Geological Survey

Municipal and Industrial Pollution

Pollution of the Rio Grande attributable to the discharge of municipal wastes is not a major problem. Although only limited analyses are available indications are that only localized quality degradations occur, those being below points of waste discharge resulting in elevated bacterial densities and biochemical oxygen demands.

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